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PROBIOTICS IN CARIES PREVENTION – A REVIEW

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Abstract
Probiotics have shown potential in the prevention of dental caries by modulating the oral microbiome and inhibiting the growth of cariogenic bacteria. This review examines current evidence on the role of probiotics in caries prevention, focusing on their mechanisms of action, the efficacy of various strains, and the practical applications in reducing the risk of dental caries. While clinical studies support the use of probiotics, particularly certain strains of *Lactobacillus* and *Bifidobacterium*, for reducing caries risk, the long-term benefits, optimal dosages, and delivery methods need further research.
KEYWORDS: Probiotics, caries prevention, Lactobacillus

INTRODUCTION

Dental caries, or tooth decay, is a widespread oral health issue caused by acid-producing bacteria like *Streptococcus mutans* and *Lactobacillus* spp., which demineralize tooth enamel. Traditional prevention methods include fluoride treatments, dietary modifications, and mechanical plaque control. However, emerging research on probiotics-live microorganisms that confer health benefits suggests they could play a key role in preventing caries by restoring balance in the oral microbiome and inhibiting harmful bacterial growth.

Mechanisms of Action

Probiotics can help prevent dental caries through several mechanisms:

- **Competition for Adhesion Sites**: Probiotics compete with cariogenic bacteria for adhesion sites on the tooth surface and mucosal tissues, preventing colonization by harmful species like *S. mutans*.
- **Production of Antimicrobial Substances**: Production of antimicrobial substances like bacteriocins, organic acids, and hydrogen peroxide inhibit the growth of cariogenic bacteria in the oral cavity.

- **pH Modulation**: Probiotics can lower the ph by producing lactic acids and other metabolites, which favors beneficial bacteria and suppresses acid-producing bacteria mainly the cariogenic bacteria.
- **Inhibition of Biofilm Formation**: Probiotics disrupt the biofilm created by cariogenic bacteria, thereby reducing plaque formation and lowering the risk of dental caries.
- **Immune Modulation**: Probiotics are responsible for modulating the host's immune response, enhancing local immune defenses against cariogenic bacteria.

Probiotic Strains in Caries Prevention

Probiotics are not equally effective in preventing dental caries. It is strain specific. Research has identified several strains that help in reducing the risk of caries development.

Lactobacillus rhamnosus

This strain has been widely studied mainly for its role in prevention of caries. *L.rhamnosus* inhibit the growth of *S. mutans* and other cariogenic bacteria. It has been used in dairy products like probiotic milk and cheese, demonstrating reduced caries incidence in children. Näse et al. (2001) conducted a study in which children who consumed milk supplemented with *Lactobacillus rhamnosus* GG showed a significant reduction in caries compared to the control group over a 2-year period(1).

Lactobacillus reuteri

L. reuteri produces reuterin, an antimicrobial substance that inhibits the growth of *S. mutans* and other pathogens. Studies have found that daily use of *L. reuteri* supplements in the form of lozenges or tablets can reduce cariogenic bacteria in saliva and dental plaque. A randomized controlled trial by Caglar et al. (2006) showed that children who used *L. reuteri* lozenges had lower levels of *S. mutans* in their saliva compared to a placebo group (2).

***Bifidobacterium* spp.**

Species like *Bifidobacterium lactis* and *Bifidobacterium longum* have demonstrated anticariogenic properties, primarily by reducing the proliferation of *S. mutans* and other acidogenic bacteria in the oral cavity. These probiotics are often included in dairy products or supplements.A study by Ahola et al. (2002) found that consuming probiotic cheese containing *Bifidobacterium* reduced the number of *S. mutans* in adult participants over a 3-week intervention period(3).

***Streptococcus salivarius* K12**

Though more commonly associated with halitosis prevention, *Streptococcus salivarius* K12 has been shown to reduce the levels of *S. mutans* and *Lactobacillus* spp., two of the primary pathogens involved in caries development. This strain is often used in lozenges or chewing gum. Tagg et al. (2009) demonstrated that regular use of *Streptococcus salivarius* K12 in the form of lozenges led to a reduction in plaque acidity and *S. mutans* counts, suggesting a role in caries prevention.

Clinical Evidence of Probiotics in Caries Prevention

Caries Risk Reduction in Children

Multiple clinical studies have shown that probiotics can reduce caries risk in children, who are susceptible to dental caries. The probiotic-enriched dairy products like yogurt and milk has been linked to a lower incidence of caries. Stecksén-Blicks et al. (2009) found that preschool children who consumed *Lactobacillus rhamnosus* GG showed fewer carious lesions over a 21-month follow-up period (4).

Effectiveness in Adults

While the majority of probiotic research has focused on children, there is evidence to suggest that probiotics may also be beneficial in adults. Studies have found that regular consumption of probiotic supplements or foods can reduce the salivary levels of *S. mutans*, lowering the overall risk of caries. The analysis by Gruner et al. (2016) showed a significant reduction in *S. mutans* counts in individuals using probiotics, with a corresponding decrease in caries incidence (5).

Probiotic Delivery Methods for Caries Prevention

Probiotics can be delivered through various forms of vehicles:

- **Dairy products**: Yogurt, milk, and cheese are common carriers for probiotics. Regular consumption of these foods has been linked to a lower caries risk.
- **Chewing gum and lozenges**: Probiotic-infused gums and lozenges allow for sustained exposure of probiotics to the oral environment, enhancing their anticariogenic effects.
- **Toothpaste and mouthwash**: Some oral care products now incorporate probiotics to promote oral health. These products provide direct application of probiotics to the teeth and gums.

Each delivery method has its advantages, but the key is consistent use to maintain a favorable microbial balance in the oral cavity.

CHALLENGES AND LIMITATIONS

While the evidence supporting probiotics in caries prevention is promising, there are several challenges:

- **Strain-Specific Effects**: Not all probiotics are effective against dental caries, and more research is needed to identify the most beneficial strains.

- **Dosage and Duration**: There is no consensus on the optimal dosage or duration of probiotic use for caries prevention. Many studies were done with varying doses which makes it difficult to establish guidelines.
- **Long-Term Efficacy**: The long-term effects of probiotics on caries prevention remain unclear. While short-term studies show positive results, more research is needed to confirm sustained benefits.
- **Regulatory Issues**: Probiotic supplements and foods are not uniformly regulated which leads to variability in product quality and probiotic viability.

CONCLUSION

Probiotics represent a promising adjunct in the prevention of dental caries. Studies indicate that strains such as *Lactobacillus rhamnosus*, *Lactobacillus reuteri*, *Bifidobacterium*, and *Streptococcus salivarius* can reduce cariogenic bacterial levels and lower the risk of tooth decay. While the evidence is strong, particularly for the usage in children.More researches has to be carried out to establish long-term efficacy, optimal dosages, and delivery methods. Probiotics are increasingly incorporated into oral care routines, they could offer a natural, effective and non-invasive way to combat dental caries.

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